REMARKS/ARGUMENTS

Reconsideration is respectfully requested.

Claims 1-3 and 5-8 are pending in the present application before this amendment. By the present amendment, claim 1 has been amended. No new matter has been added.

In the office action, claims 1-2 and 5 stand rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent Application Publication No. 2004/0113235 (Coolbaugh) in view of U.S. Patent No. 6,475,854 (Narwankar II). The "et al." suffix in a reference name is omitted.

The applicant respectfully reasserts the remarks/arguments of the last filed amendment of July 25, 2005 and respectfully submits again the presently claimed invention not taught or suggested by Coolbaugh, even if this reference is considered in combination with the newly cited Narwankar II reference.

The presently claimed invention is directed to a very novel process of forming a four layer capacitor structure of, for example, a copper layer 300 and the layer 400 of TaN, Ta, Ti, TiN, or Ru, together forming the lower electrode, a dielectric layer 450 formed by oxidizing the layer 400, and the upper electrode layer 500 of TaN, Ta, Ti, TiN, or Ru. The layers 400, 450, and 500 are formed in-situ in one equipment.

To further clarify the presently claimed invention, claim 1 has been further amended so that the lower electrode layer 400 is made from TaN, Ta, Ti, TiN, or Ru (specification page 6, lines 14-17) and the dielectric layer 450 or 450a is made by oxidizing the **upper surface** of the lower electrode layer 400 (see FIG. 10 and specification page 6, line 24 to page 7, line 5).

Coolbaugh does not teach or suggest, inter alia, the above claim 1 as amended.

Coolbaugh as clearly depicted in FIG. 5F teaches forming the capacitor 100 (see FIG. 5F) by a six step process as follows:

(1) electroplating the copper lower electrode 18 having the pedestal 40;
(2) depositing **the barrier layer 50 preferably of tungsten** to cover up the exposed pedestal 40;
(3) depositing a precursor layer 60, preferably of TaN;
(4) anodic oxidation of the precursor layer 60 to form the dielectric layer 62;
(5) depositing a seed layer of Ta/TaN/Cu on the dielectric layer 62; and
(6) electroplating the copper upper electrode layer 66.

The resulting structure of the Coolbaugh's capacitor 100 is at least a five-layer structure (copper lower electrode, **tungsten barrier metal**; dielectric layer; a seed layer; and a copper upper electrode), and this is quite different from the four layer capacitor structure of the presently claimed invention in terms of both the structure and process as shown in FIG. 12 (the copper metal layer 300; **the lower electrode layer 400; the dielectric layer 450a**; and the upper electrode layer 500).

That is, as shown in FIG. 12 of the present invention, the lower electrode 400 is formed on the copper metal layer 300. In contradistinction, Coolbaugh requires one additional layer of the tungsten barrier layer 50 (see Coolbaugh ¶ [0052] and FIG. 5F) formed on the copper layer 18, 40, and then forming a dielectric layer 62 on the tungsten barrier layer 50. Coolbaugh requires the barrier layer 50 preferably of tungsten because of the pedestal 40 that is the central subject matter of the Coolbaugh's invention taught and disclosed. Unlike Coolbaugh, the presently claimed invention requires no such barrier layer to separate any portion of the lower electrode and the dielectric layer. This alone clearly shows that Coolbaugh is different from the

presently claimed invention and does not teach claim 1.

Further, the claimed dielectric layer 450a (FIG. 12) is formed by oxidizing the --upper surface-- of the lower electrode layer. In no case, the present invention suggests that the claimed lower electrode layer 400 will be fully converted into the dielectric layer through oxidation. However, Coolbaugh suggests that the dielectric layer 62 is formed by "partially or completely" oxidizing the "precursor layer 60" which is preferably TaN (Coolbaugh ¶ [0053]). From Coolbaugh FIG. 5F, which shows the final structure, it is clearly shown that the dielectric layer 60 is formed by completely oxidizing the "precursor layer 60" (as the layer 60 is not shown in Coolbaugh FIG. 5F). In this case, Coolbaugh teaches the five-layer capacitor structure of 18, 50, 62, 64, and 66. Even if the precursor layer 62 is assumed to be partially oxidized, Coolbaugh will then teach a six-layer capacitor structure of 18, 50, 60, 62, 64, and 66, and this is completely different from the presently claimed invention.

In addition, claim 1 has been further amended to recite that TaN, Ta, Ti, TiN, and Ru materials for the lower electrode layer 400 are in amorphous state when one of them is deposited on the metal layer to have a superior oxidation characteristics (specification page 6, lines 18-23). Nowhere in Coolbaugh teaches this additionally amended limitation.

Further, the claimed upper electrode 500 is not copper, unlike Coolbaugh which teaches the copper electrode 66. Rather, the claimed upper electrode 500 is one of the **same** materials TaN, Ta, Ti, TiN, and Ru that can be selected to form the lower electrode layer 400. This selection of material for the claimed upper electrode 500 that is not copper is quite different from Coolbaugh and provides significant advantage over

Coolbaugh in a way that the formation of the layers 400, 450, and 500 is completed **in-situ** without change of equipment. This in-situ is possible partly because the material for the upper electrode 500 is selected from one of those materials that are available for selection in forming the lower electrode layer 400.

In the office action page 2, the examiner cites Coolbaugh ¶ [0058] to assert that Coolbaugh allegedly teaches that its electrode 66 can be made from TaN; however, the applicant cannot find such teaching in this paragraph. Rather, Coolbaugh ¶ [0058] teaches that a copper layer 66 covers the "Ta/TaN/Cu seed layer 64."

At least for the reasons above, not every claimed limitation is taught or suggested by Coolbaugh, whether this reference is considered in combination with any other cited references.

Further, the applicant respectfully points out erroneous reasoning of the statement of obviousness as stated in the office action page 3, top, that an ordinary skill in the art will form the layers taught in Coolbaugh in situ without change of equipment, because Narwankar II teaches in situ processing. That is, Coolbaugh reference provides no teaching or suggestion of in situ processing. In fact, Coolbaugh **teaches against** the in situ processing. In order to form the capacitor 100, Coolbaugh teaches three different processes of (1) deposition of various seed layers, (2) electroplating process of the seed layer to form a copper metal layer, and (3) anodic oxidation process, and carrying out the all of which processes would require at least one equipment change.

Thus, the in situ processing as the office action indicates as allegedly taught in Narwankar II is **not properly combinable** with Coolbaugh that teaches away from in

situ processing.

According to MPEP §2143.01, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference to combine the reference teaching.

The suggestion or motivation to combine references must come from the cited prior art references, either explicitly or implicitly. The mere fact that the teachings of the prior art **can** be modified or combined **does not** establish a motivation or suggestion to combine and make the resultant combination prima facie obvious. **The prior art must suggest the desirability of the combination.** MPEP §2143.01. In the present case, Coolbaugh utterly fails to suggest the desirability of the combination with Narwankar II or any other reference to teach in situ processing.

For the reasons set forth above, the applicant respectfully submits that claims 1-3 and 5-8, now pending in this application, are in condition for allowance over the cited references. This amendment is considered to be responsive to all points raised in the office action. Accordingly, the applicant respectfully requests reconsideration and withdrawal of the outstanding rejections and earnestly solicits an indication of allowable subject matter.

Should the examiner have any remaining questions or concerns, the examiner is encouraged to contact the undersigned attorney by telephone to expeditiously resolve such concerns.

Respectfully submitted,

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